AQA GCSE Biology | 8461

SPECIFICATION POINT 4.3.2.1

# Producing monoclonal antibodies

## Past-paper questions

| | |
|---|---|
| Tier | **Higher** |
| Question groups | **6** |
| Available paper years | **2018–2025** |

## Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

**Name:** _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

### 4.3.2.1 Producing monoclonal antibodies

**Question 01**

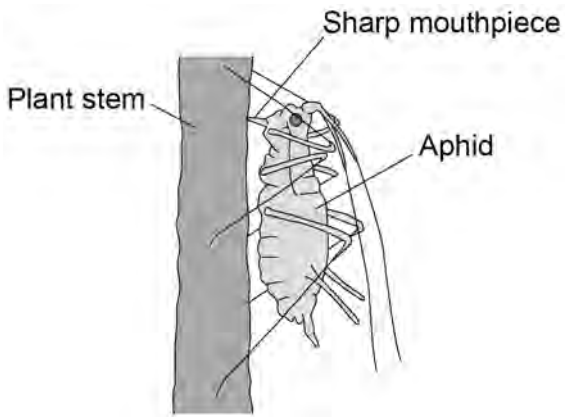
June 2018 | 8461/1H | Original Q5

**0 5** Plants can be infected by fungi, viruses and insects.

Aphids are small insects that carry pathogens.

**Figure 6** shows an aphid feeding from a plant stem.

**Figure 6**




**0 5 . 1** An aphid feeds by inserting its sharp mouthpiece into the stem of a plant.

Give the reason why the mouthpiece of an aphid contains a high concentration of dissolved sugars after feeding.

**[1 mark]**

**Question 5 continues on the next page**

### 4.3.2.1 Producing monoclonal antibodies

**Question 01 · continued**



**0 5 . 2** Plants infected with aphids may show symptoms of magnesium deficiency.

Magnesium deficiency symptoms include:

- yellow leaves
- stunted growth.

Explain how a deficiency of magnesium could cause these symptoms.

**[5 marks]**

### 4.3.2.1 Producing monoclonal antibodies

**Question 01 · continued**



**0 5 . 3** A farmer thinks a potato crop is infected with potato virus Y (PVY).

The farmer obtains a monoclonal antibody test kit for PVY.

To make the monoclonal antibodies a scientist first isolates the PVY protein from the virus.

Describe how the scientist would use the protein to produce the PVY monoclonal antibody.

**[4 marks]**

10

### 4.3.2.1 Producing monoclonal antibodies

**Question 02**

June 2019 | 8461/1H | Original Q8

**0 8** Pancreatic cancer develops when a malignant tumour grows inside the pancreas.

**0 8 . 1** The pancreas produces digestive enzymes.

What is an enzyme?

**[2 marks]**

**0 8 . 2** Carbohydrase is an enzyme produced by the pancreas.

Name **two** other organs in the digestive system that produce carbohydrase.

**[2 marks]**

1 _____

2 _____

**0 8 . 3** One symptom of pancreatic cancer is weight loss.

Explain how pancreatic cancer may cause a person to lose weight.

Do **not** refer to hormones in your answer.

**[4 marks]**

4.3.2.1 Producing monoclonal antibodies

Question 02 · continued



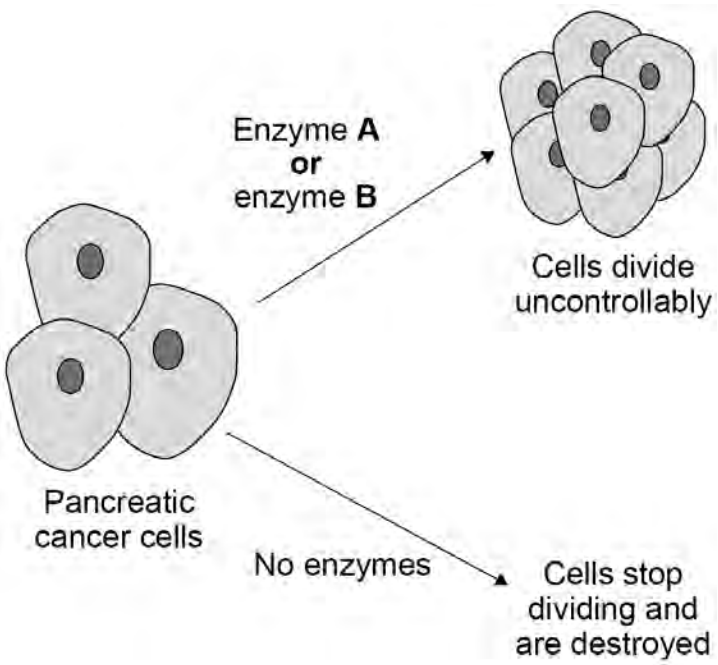
Enzyme **A** and enzyme **B** are involved in controlling cell division in pancreatic cancer cells.

Most cancer cells produce both enzyme **A** and enzyme **B**.

Some people have a gene mutation that stops cancer cells producing enzyme **B**.

**Figure 9** shows how cell division is controlled in pancreatic cancer cells.

**Figure 9**



4.3.2.1 Producing monoclonal antibodies

Question 02 · continued



Scientists have developed a drug that inhibits enzyme **A**.

The drug is given to pancreatic cancer patients who have the gene mutation that stops cancer cells producing enzyme **B**.

The drug only targets cancer cells.

**0 8 . 4** Explain why the drug can be used to treat pancreatic cancer in patients with the gene mutation.

Use information from **Figure 9**.

**[3 marks]**

**0 8 . 5** Explain why the drug could **not** be used to treat pancreatic cancer in a patient that produces both enzyme **A** and enzyme **B**.

**[2 marks]**

**Question 8 continues on the next page**

4.3.2.1 Producing monoclonal antibodies

Question 02 · continued



**0 8 . 6** The drug was trialled before it was licensed for use.

To improve validity of the results in the trial:

- some patients were given a placebo
- a double-blind trial was used.

Give reasons why a placebo and a double-blind trial were used.

**[2 marks]**

A placebo _____

_____

_____

A double-blind trial _____

_____

_____

**0 8 . 7** One stage in a drug trial is to test the drug on healthy volunteers.

What is the next stage in the drug trial?

**[1 mark]**

Tick (✓) **one** box.

Testing on all patients with the disease ☐

Testing on human tissue ☐

Testing on live animals ☐

Testing on volunteers with the disease ☐

### 4.3.2.1 Producing monoclonal antibodies

**Question 02 · continued**



**0 8 . 8** A monoclonal antibody has been produced to treat pancreatic cancer.

Explain how the monoclonal antibody works to treat pancreatic cancer.

**[3 marks]**

**19**

### 4.3.2.1 Producing monoclonal antibodies

**Question 03**

November 2020 | 8461/1H | Original Q7

**0 7** Monoclonal antibodies (mAbs) are usually made using mouse lymphocytes.

*Candida albicans* infection produces serious symptoms in patients with a poor immune system.

Recently scientists have produced mAbs to *Candida albicans* using human lymphocytes produced naturally after an infection.

**0 7 . 1** *Candida albicans* lives in the throat of infected patients.

A sample is taken from the throat of a patient with a suspected *Candida albicans* infection.

The sample is transferred onto a microscope slide.

Describe how the mAbs and a fluorescent dye could be used to see any *Candida albicans* pathogens on the slide.

**[3 marks]**

4.3.2.1 Producing monoclonal antibodies

Question 03 · continued



In a laboratory the human lymphocyte mAbs were injected into animals infected with *Candida albicans*.

The mAbs caused increased phagocytosis of the *Candida albicans* pathogens.

Doctors intend to start a trial to give the mAbs to patients severely ill with *Candida albicans.*

**0 7 . 2** Explain how increased phagocytosis of the *Candida albicans* pathogen will help the patient.

**[2 marks]**

**Question 7 continues on the next page**

4.3.2.1 Producing monoclonal antibodies

Question 03 · continued



**0 7 . 3** It has been shown that this mAbs treatment is effective in the laboratory using both:

- infected tissue culture cells
- infected live animals.

The mAbs treatment for *Candida albicans* is now ready for clinical trials on people.

Describe how the clinical trials should be carried out.

**[6 marks]**

### 4.3.2.1 Producing monoclonal antibodies

**Question 03 · continued**



**0 7 . 4** Scientists have also used human lymphocytes to make mAbs to other pathogens and to some types of cancer cells.

Suggest **one** reason why these new mAbs have been more successful in treating diseases in humans than mAbs made using mice.

**[1 mark]**

_____

_____

_____

**12**

### 4.3.2.1 Producing monoclonal antibodies

**Question 04**



**0 7** Human immunodeficiency virus (HIV) is a pathogen.

**0 7 . 1** Give **one** way HIV can spread from one person to another person.

**[1 mark]**

**Table 8** shows information about new cases of HIV diagnosed in the UK.

**Table 8**

| Year | Number of new HIV cases in women | Number of new HIV cases in men |
|---|---|---|
| 2010 | 376 | 2266 |
| 2012 | 361 | 2310 |
| 2014 | 397 | 2370 |
| 2016 | 298 | 1886 |
| 2018 | 242 | 1288 |

**0 7 . 2** Describe the trends shown in **Table 8** between 2010 and 2018.

**[2 marks]**

**0 7 . 3** Suggest **one** reason for the change in the number of new HIV cases between 2014 and 2018.

**[1 mark]**

4.3.2.1 Producing monoclonal antibodies

Question 04 · continued



**0 7 . 4** Calculate the ratio of new cases of HIV in women to new cases of HIV in men in 2018.

Give your answer to 3 significant figures.

**[3 marks]**

Ratio (3 significant figures) = _____ : 1

**0 7 . 5** In the UK population the total number of women is greater than the total number of men.

The data in **Table 8** is used to compare the proportions of new cases of HIV in the population for men and women.

Suggest how the data could be presented differently so that a more valid comparison can be made.

**[1 mark]**

**Question 7 continues on the next page**

4.3.2.1 Producing monoclonal antibodies

Question 04 · continued



Scientists have been working to produce a vaccine for HIV for many years.

**0 7 . 6** Explain how a vaccine for HIV could work to prevent a person developing HIV infection.

**[4 marks]**

A person with late stage HIV infection has AIDS.

Scientists have produced monoclonal antibodies for HIV.
The monoclonal antibodies can prevent a person infected with HIV developing AIDS.

**0 7 . 7** Describe how the monoclonal antibody for HIV can be produced.

**[4 marks]**

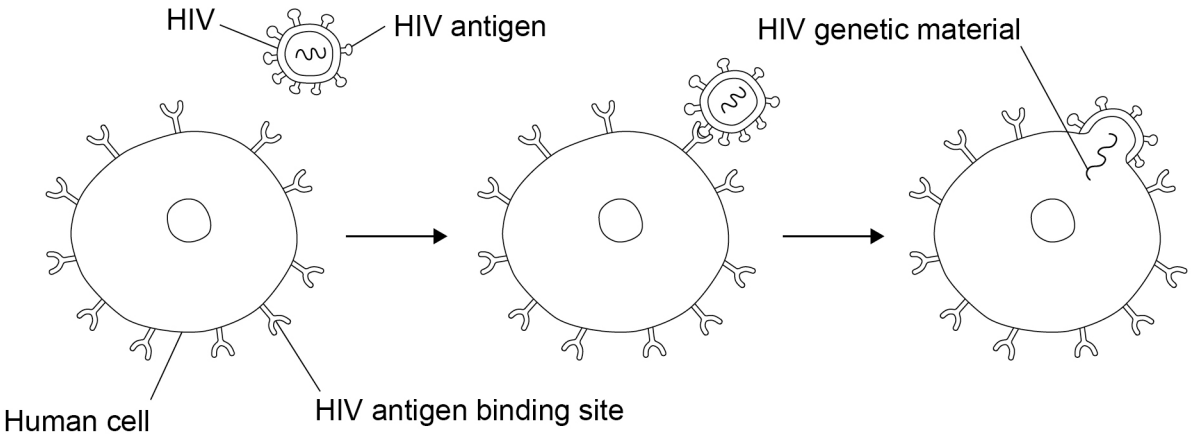
4.3.2.1 Producing monoclonal antibodies

Question 04 · continued



**0 7 . 8** **Figure 9** shows how HIV enters a human cell.

**Figure 9**




Suggest how the monoclonal antibody for HIV helps to prevent a person infected with HIV developing AIDS.

Use information from **Figure 9**.

**[3 marks]**

19

### 4.3.2.1 Producing monoclonal antibodies

**Question 05**

June 2023 | 8461/1H | Original Q4

**0 4** This question is about exercise.

**0 4 . 1** During vigorous exercise, anaerobic respiration occurs in a person's body.

Explain **two** effects of anaerobic respiration on the person's body.

**[4 marks]**

1 _____

2 _____

4.3.2.1 Producing monoclonal antibodies

Question 05 · continued



**0 4 . 2** Design an investigation to show the effect of different types of exercise on the heart rate of athletes.

**[6 marks]**

**Question 4 continues on the next page**

4.3.2.1 Producing monoclonal antibodies



Anabolic steroids are drugs.

Anabolic steroids:

- increase muscle mass in humans
- are banned in most competitive sports.

Some athletes take anabolic steroids to improve their performance in sport.

**0 4 . 3** Explain how taking anabolic steroids could improve an athlete's performance.

**[2 marks]**

Scientists use monoclonal antibodies to test for the presence of anabolic steroids in an athlete's urine.

To produce monoclonal antibodies, a mouse lymphocyte is combined with a tumour cell.

**0 4 . 4** What type of cell is created when a mouse lymphocyte and a tumour cell combine?

**[1 mark]**

Tick (✓) **one** box.

- Embryo ☐
- Hybridoma ☐
- Phagocyte ☐
- Stem cell ☐

4.3.2.1 Producing monoclonal antibodies

Question 05 · continued



**0 4 . 5** Describe how scientists make monoclonal antibodies using the cell created when a mouse lymphocyte and a tumour cell combine.

**[3 marks]**

**0 4 . 6** What property makes a monoclonal antibody useful in detecting the presence of an anabolic steroid in urine?

**[1 mark]**

Tick (✓) **one** box.

A monoclonal antibody is quick and easy to produce. ☐

A monoclonal antibody is specific to only one person's urine. ☐

A monoclonal antibody only binds to the anabolic steroid. ☐

A monoclonal antibody can identify many different drugs at the same time. ☐

**Question 4 continues on the next page**

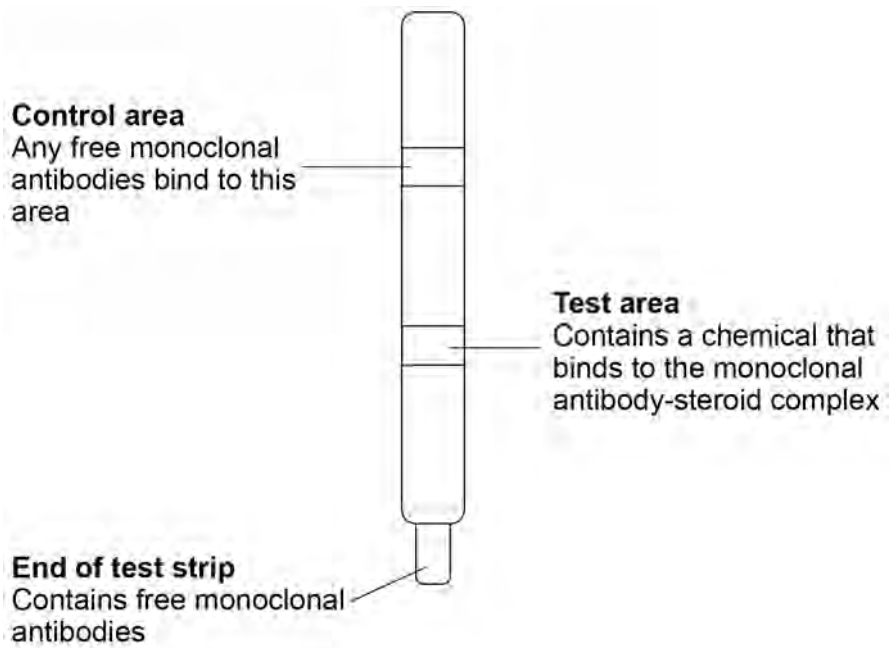
4.3.2.1 Producing monoclonal antibodies

Question 05 · continued



**Figure 5** shows a test strip that can detect the presence of an anabolic steroid in an athlete's urine.

**Figure 5**




The end of the test strip is dipped in urine.

The urine moves up through the test strip.

The test area and the control area contain a dye.
The dye turns blue when monoclonal antibodies bind to it.

**0 4 . 7** Suggest the purpose of the control area in the test strip.

**[1 mark]**

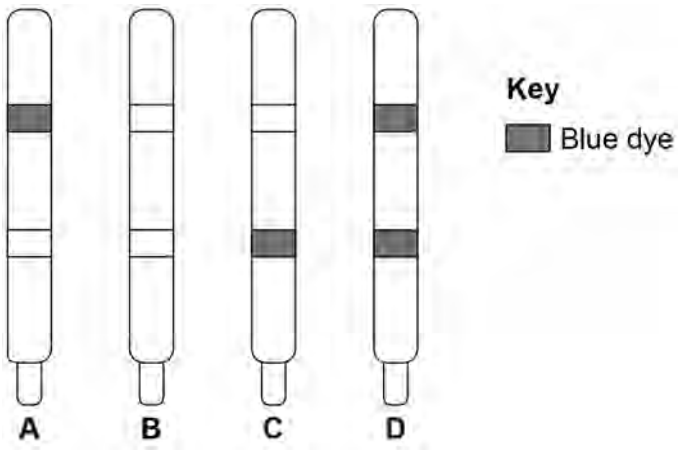
4.3.2.1 Producing monoclonal antibodies

Question 05 · continued



**Figure 6** shows the urine test results of four athletes.

**Figure 6**




**0 4 . 8** Describe the evidence in **Figure 6** that shows the test for athlete **B** has **not** worked.

Suggest **one** reason why the test did **not** work.

**[2 marks]**

Evidence _____

_____

Reason _____

_____

**0 4 . 9** Which athlete has tested positive for anabolic steroids in their urine?

**[1 mark]**

Tick (✓) **one** box.

**A** ☐ **B** ☐ **C** ☐ **D** ☐

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### 4.3.2.1 Producing monoclonal antibodies

**Question 06**

June 2025 | 8461/1H | Original Q7

**0 7** In people with severe liver disease the liver stops working correctly.

A person with severe liver disease can be treated with:

- an injection of embryonic stem cells
  or
- a liver transplant from a donor.

The person's body can reject embryonic stem cells and can reject a liver transplanted from a donor.

**0 7 . 1** What property of embryonic stem cells makes them suitable to treat liver disease?

**[1 mark]**

**0 7 . 2** Suggest **one ethical** reason why a person may **not** want an injection of embryonic stem cells.

**[1 mark]**

4.3.2.1 Producing monoclonal antibodies

Question 06 · continued



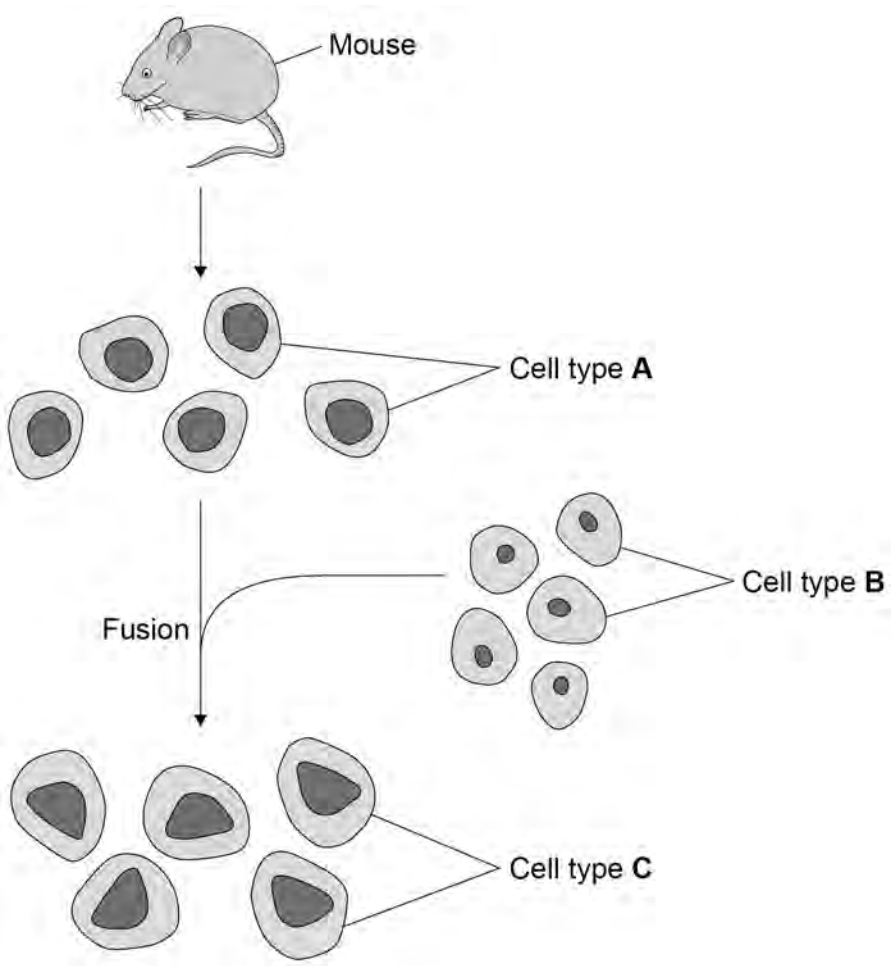
Drugs can be used to reduce the risk of liver rejection after a transplant.

One drug contains monoclonal antibodies.

The monoclonal antibodies are specific to an antigen on the surface of liver cells.

**Figure 9** shows part of the process used to create the monoclonal antibodies.

**Figure 9**




**0 7 . 3** Name the **three** types of cell in **Figure 9**.

**[3 marks]**

**A** _____

**B** _____

**C** _____

4.3.2.1 Producing monoclonal antibodies

Question 06 · continued



**0 7 . 4** How is the mouse stimulated to produce cell type **A**?

**[1 mark]**

**0 7 . 5** A patient with severe liver disease was given a liver transplant.

The drug containing the monoclonal antibody is given to the patient.

Explain how the monoclonal antibody stops the patient's white blood cells from attacking the cells of the donor liver.

**[3 marks]**

**0 7 . 6** Give **one** other use of monoclonal antibodies.

Do **not** refer to pregnancy tests.

**[1 mark]**

**Question 7 continues on the next page**

4.3.2.1 Producing monoclonal antibodies



The liver produces bile.

Bile is needed for efficient digestion.

**0 7 . 7** Where is bile stored in the human body?

**[1 mark]**

Tick (✓) **one** box.

- Gall bladder ☐
- Kidney ☐
- Pancreas ☐
- Small intestine ☐

**0 7 . 8** Explain why a person with severe liver disease has difficulty digesting fats.

**[6 marks]**

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